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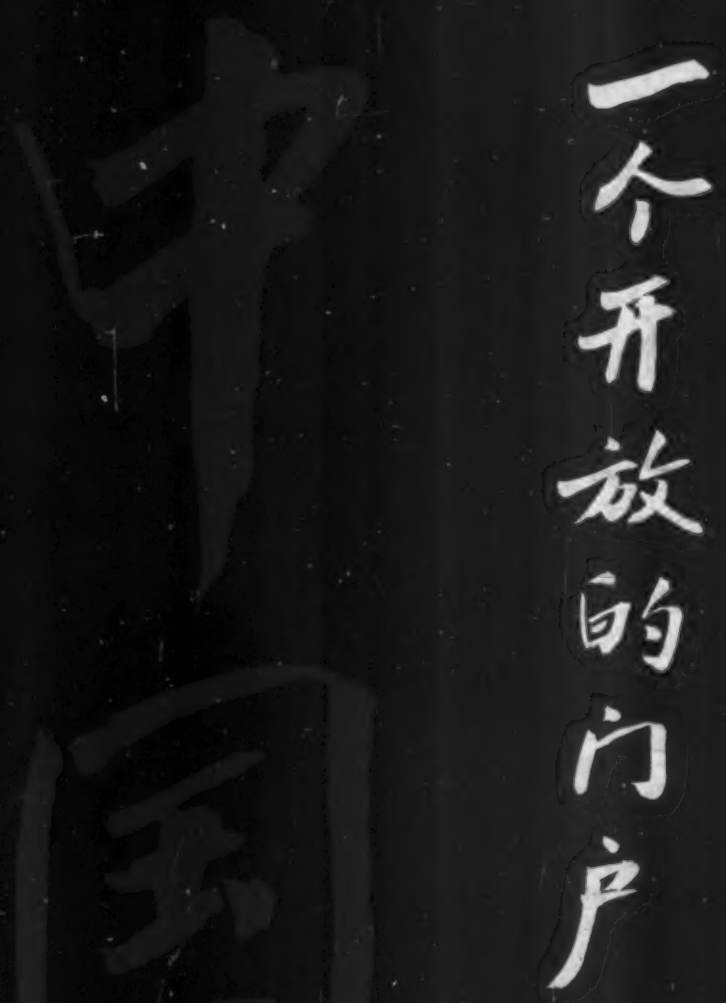
Reclamation era

Vol. 65 No. 2



Reclamation

era

Vol. 65 No. 2

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Water and Power
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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island Territories under U.S. administration.

Cover Translation
China: An Opening Door
(See article on pg. 3)

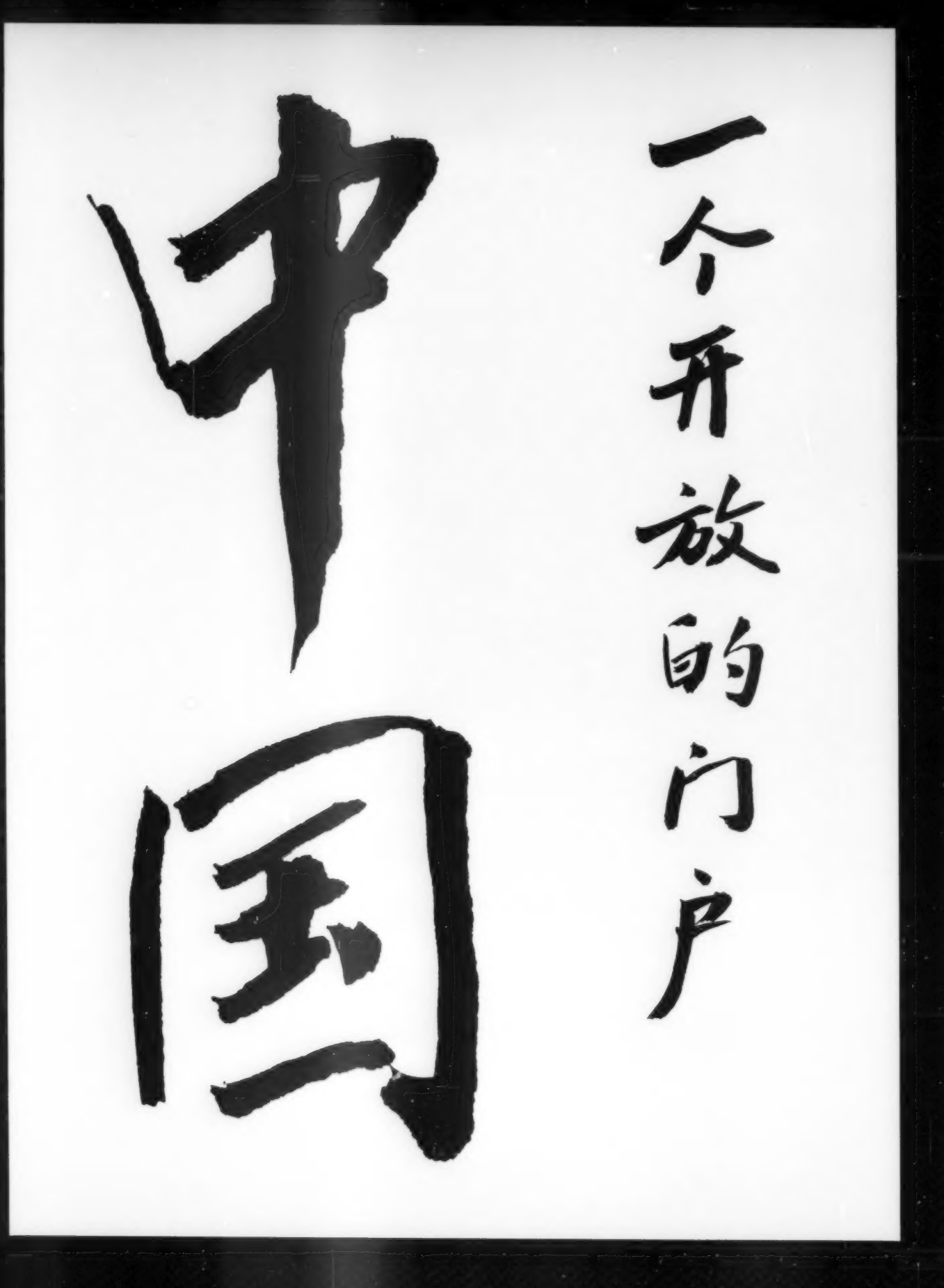
News Brief
New Name for Bureau of Reclamation — 1

New Name for Bureau of Reclamation

After nearly 78 years as the "Reclamation Service" and the "Bureau of Reclamation," the agency has changed its name. Effective November 6, 1979, the new name is Water and Power Resources Service.

Commissioner R. Keith Higginson announced the new name at the National Water Resources Association Convention in Denver. He said, "I recommend the change of name because times have changed...We are responsive to national pressures...concerns about energy, a growing awareness of what in the near future will be a water crisis, and changing government roles in resource management... We need a name that signifies to all Americans our commitment to the responsible development and use of water resources and energy, of which hydro power plays a significant and up-to-now a largely unrecognized role with great future potential...The name shows clearly that we are involved in the conservation and wise development of the Nation's water and related power resources."

The name change was accomplished by Secretarial Order. Appropriate legislation for any changes which may be recommended in the scope of the Service's authority will be requested from the Congress. Also, the Act of May 26, 1926, which amends the Reclamation Act of 1902 prescribing that the function of reclamation of arid lands in the West be directed by a Commissioner of Reclamation, will need to be amended by the Congress. The new title for the head of the Water and Power Resources Service will be the Commissioner of Water and Power Resources. ■


一个开放的门户
中国

CHINA:

An Opening Door

By Donald A. Giampaoli

The Peoples Republic of China (PRC) has extensive hydropower and thermopower resources. Recently, I had the privilege of seeing some of these resources firsthand during a visit to that country.

Since 1949, China has implemented a policy stressing the simultaneous construction of large, medium-size, and small hydropower and thermopower facilities.

The nation's hydro resources are considerable. For example, the Yangtze River, China's longest river traversing some 6,300 kilometers, has two-fifths of the country's total hydropower potential.

Hydroelectric power accounts for 27 percent of China's existing power generation of 256.5 billion kilowatt-hours. In the United States, hydropower accounts for only 15 percent of the total electric power produced.

The installed capacity of hydroelectric plants is 14,000 megawatts. This does not include small hydroelectric stations in the provinces.

The National Science Foundation's International Division and the Division of Problem-Focused Research Applications made a joint award to the University of Illinois to lead a group of engineers and scientists, on a visit to research and academic institutions in China. The group visit was sponsored by the China Civil Engineering Society, a counterpart to the American Society of Civil Engineers.

Burial place of the Ming emperor Ting Ling, 30 miles north of Beijing.

It was with this group that I traveled to the Peoples Republic of China with representatives from academic institutions (Universities of California, Illinois, Kentucky, and Michigan); consulting firms (Fugro, Inc., Harza Engineering Co., and Stone and Webster Engineering Corp.); and other Federal agencies (Army Corps of Engineers, Geological Survey, and Nuclear Regulatory Commission).

The purpose of our visit was to observe Chinese experience and practices related to a broad spectrum of research and development. My particular interest was safety, design, and construction of earth dams and other embankment structures.

Another objective of the visit was to evaluate the state-of-the-art of Chinese technology to identify, collectively, areas of possible cooperative study.

During the period August 28 to September 10, 1979, the group traveled to Beijing (the new Pinyin spelling for Peking), population 7.5 million; Harbin, population 2.5 million; Nanjing (Pinyin spelling for Nanking), population 2.5 million; and Shanghai, population 11 million.

Most of our time was spent in Beijing. There we lectured, and listened to lectures by representatives of the China Civil Engineering Society and other Chinese engineers and scientists. We made professional visits to the Scientific Research Institute of the Ministry of Railroads, the Scientific

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Photography by the author.

Research Institute of the Ministry of Water Conservancy, and the Scientific Research Institute of Architecture.

In addition, we visited Chinese historical sites of world renown including the Great Wall, which stretches from Po Hai Sea in the east to Chiayukuan in Kansu Province to the west over a length of approximately 4,990 kilometers (3,100 miles). The Wall was constructed during the period 480 B.C. to 207 B.C., averaging 6.7 meters (22 feet) in height and 5.8 meters (19 feet) in width, with battlements built at intervals of 140 meters (459 feet). Other visits included the Ming Tombs, which date back to the Chou Dynasty in 1584, and a tour of the Summer Palace, including Kimming Lake, a favorite touring site of Beijing residents.

The Imperial Palace, also known as the Forbidden City, was also on the tour agenda. In the heart of Beijing, the Palace comprises the largest and most complete group of ancient buildings surviving to the present age. Built during the period 1406-20 under the reign of Ming Emperor Yung Lo, it was inhabited by each of the twelve Ming Emperors. Overall, the grounds cover an area of 101 hectares (250 acres) surrounded by a moat and a 11.67 meter (35-foot) wall. The Palace has now been converted into a museum and is open to the public.

A highlight of the trip was a personal meeting with Vice Minister Li Rui and fourteen members of his principal staff at the headquarters of the Ministry of Electric Power in Beijing. With Mr. Li Rui were the Chief Engineer of Hydraulic Electrogenerating Construction, the Senior Engineer of the Ministry, as well as other top-level technical officials.

Our discussions included the coordination between the National Science Foundation and its China counterpart; Water and Power's planning, design, construction, and operation and maintenance process; dam safety activities; the Service's state-of-the-art evaluation of seismic effects related to Auburn Dam; and the opportunities for seismic analysis in China.

Size and Number of Dams in China

Currently the highest completed concrete gravity structure in China is 146 meters (470 feet) high. The highest completed embankment-type structure is 100 meters (328 feet) high. A 164-meter (541 feet) concrete gravity (Wujiang du Dam) structure is currently being constructed and a 240-meter (787 feet) concrete gravity dam is in the process of design.

I indicated an awareness of the current construction of Gezhouba Dam on the Yangtze River, which may eventually be a re-regulating dam downstream from the proposed Three Gorges site. Gezhouba Dam is a 69.7 meter (229 feet) high concrete gravity structure.

There are over 300 major dams in China, impounding reservoirs greater than 100 million cubic meters (81,000 acre-feet) and 2,200 structures impounding reservoirs in the 10 to 100 million cubic meter (8,100-81,000 acre-feet) range. The literature indicates over 60,000 medium-size and small hydropower stations have been built throughout the country. Of these, 56,000 hydropower stations have been built in the last 10 years or so. Since 1949, I understand that over 81,000 reservoirs have been completed.

Dam Safety Activities in China

Independent reviews by the Capital Construction Commission, which administers the public works budget, and National Central Construction and Planning Committees are designed to help guarantee the safety of their dams. They have regulations for their dams' reviews and acceptance, in addition to a construction quality-control program which includes locating design engineers at construction sites. As we do, when the foundation is excavated, design engineers review and accept the site. In addition, major reservoirs are not allowed to fill unless the Ministry of Electric Power accepts the work.

Mr. Li's staff noted some dam-safety related problems such as underestimating flood hydrology and the timely preparation of designers' operating criteria and standard operating procedures. Seismic effects, such as liquefaction settlements and cracking of concrete, have created partial distress of some dams. One recent storm released 40 inches of precipitation in a 24-hour period making the structures susceptible to extreme hydrologic changes, as well as the known seismic activity. The Chinese also experience siltation problems in reservoirs and deep sand-gravel overburden in river beds.

Other general information that I learned during my visit in Beijing include:

- more than 90 percent of the dams in China are of the earth-rockfill type with rolled fill of clay-type soil;
- few rockfill dams are built in China because of the lack of appropriate construction equipment;
- there are over 26 ministries in China and more are anticipated, as some are being divided into specific functional areas;
- the Ministry of Electric Power is responsible for all power-related activities except nuclear, which is administered by the China Academy of Science;
- most ministries have their own research facilities;

The author at the Imperial Palace in Beijing.

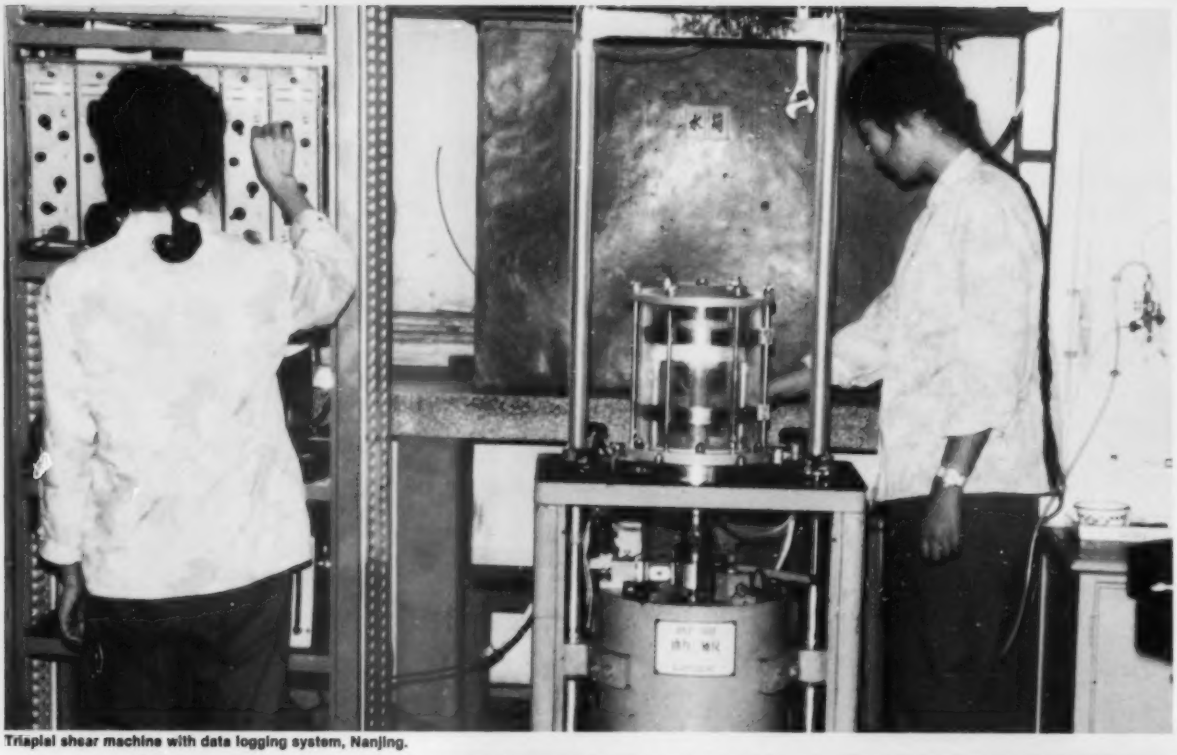
- major dam design is performed in Beijing;
- and the city of Wuhan is an important location to visit in the future, since it is the site of the PRC National Central Construction Committee and National Central Planning Committee.

On September 2, 1979, we flew to Harbin, an industrial and rail center located 1,117 kilometers (694 miles) north of Beijing. We were hosted by the Civil Architecture Society of Heilongjian Province. Most of our time in Harbin was spent in discussions with representatives of the Institute of Engineering Mechanics, established in 1954 as the Institute of Civil Engineering and Architecture of the Chinese Academy of Science. It was renamed in 1962 in order to specialize in earthquake engineering and recently started concentrated work in rock mechanics. The Institute places a heavy stress on advanced science and technology. We left Harbin by plane to Beijing on September 4, 1979.

Following a 17-hour train ride from Beijing, we arrived in Nanjing about mid-afternoon, September 5, where the group was hosted by the Civil Architecture Society of Jiangsu Province. Nanjing, located about 1,159 kilometers (720 rail miles) south of Beijing, is in one of China's most splendid natural locations. Situated in a basin formed by the Yangtze River on the north and the Tsechin Mountains on the other sides, the city's dominant feature is the Yangtze River Bridge built in 1968. The bridge serves a major symbolic importance to all Chinese as it forms a direct overland link between the lower Yangtze Valley (including Shanghai and Nanjing) and the capital Beijing.

The Yangtze River Bridge, its abutments 1,576 meters (5,171 feet) apart, stretches over 21.34-meter (70-foot) depths of silt-laden waters covering a bedrock floor. Relying completely on their own efforts, the Chinese undertook the construction of the bridge in 1960 after outsiders quit the task. Other places of interest were Sun Yat-sen Mausoleum and Ling Ju Park.

Touring in Nanjing was brief, as most of the time was spent in technical discussions and



Triaxial shear machine with data logging system, Nanjing.

Small shaking table, Beijing.

laboratory tours with representatives of the East China College of Hydraulic Engineering and the Nanjing Hydraulic Engineering Research Institute of the Ministry of Water Conservancy and Ministry of Communication.

The East China College of Hydraulic Engineering, founded in 1952, is the first higher-learning institution of science and technology on hydraulic engineering in China. Specialties include: design of hydraulic structures, mechanical and electrical installation of hydroelectric plants, waterway and harbor engineering, irrigation and drainage engineering, hydrology, engineering oceanography, mechanics of hydraulic structures, automation of hydroelectric plants, and applied computer analysis.

The Nanjing Hydraulics Engineering Research Institute, established in 1935, specializes in four research areas: engineering hydraulics, rivers and harbors, soils engineering, and construction engineering and materials. The Institute also conducts research for other departments and ministries of the PRC, in addition to that performed for foreign countries.

On September 7 we departed from Shanghai by train, a distance of approximately 320 kilometers (200 miles). Shanghai in the last 30 years has become a major industrial center, and is by far China's most consumer-oriented city with more than 17,000 shops. The main shopping street, Nanjing Road, is so crowded that it is virtually impassable by car. Shanghai is the center of China's trade and industry since about half of the nation's entire internal and external commerce passes through the city via ocean vessels, river craft, airplanes, and railroads.

Hosted by the Shanghai Civil Engineering Society, we spent the remainder of our visit with lectures, in workshops, and on laboratory tours with representatives of Tongji University. The technical activity at the university appears to be primarily concerned with building construction and associated seismic analysis. Therefore there was considerable interest in the Service's state-of-the-art studies at Auburn.

Research Activities in China

Examples of research and technical discussions cited at each location follow:

The Marble Barge at the Summer Palace near Beijing.

The damage to Douhe Dam during the Tangshan Earthquake of July 28, 1976, was described. The dam located in the suburb of Tangshan City, is a homogeneous earthfill structure impounding a reservoir of 340,000,000 cubic meters (275,640 acre-feet). The magnitude of the earthquake was 7.8 M and the seismic intensity at the epicenter was 11 degrees, according to the new China Seismicity Scale. The dam's length is 6,115 meters (20,062 feet), with a maximum height of 22 meters (72 feet). The main damage to the dam involved longitudinal cracks along the upstream and downstream slopes, crest settlement and toe heaves. It has been found that the damage was mainly caused by liquefaction of saturated silts and spreading of soft clays in the foundation . Considerable research effort is being undertaken by the Chinese to solve liquefaction problems.

Other discussions and reports received include:

- "Earthquake Damage of Baihe Earth Dams and Liquefaction Characteristics of Sand and Gravel Materials;"
- "Experimental Analysis of Seepage Stability of Sand-Gravel Foundation under the Dam of Lunghekou Reservoir;"
- "Finite Element Analysis of Unsteady Seepage flow and Slope Stability of Earth Dams;"
- "Earthquake Loads for Hydraulic Structures."

Harbin

Preliminary analysis of the causes of slope failure at the Bai River rockfill dam (Miyun Reservoir) subjected to the Tangshan Earthquake was reviewed. The dam is 60.5 meters (198 feet) high and the crest length is 160 meters (525 feet). The epicenter was 150 kilometers (93 miles) from the structure. An available report of this work completed in 1977 will require translation. Other reports called to our attention in Harbin are available and some will also require translation. It was noted that they are behind in receipt of technical literature from the United States by 1-1/2 to 2 years.

Nanjing

Seismic design of Liu Ja Xia Dam involving a systematic study of dynamic characteristics of this gravity structure (reservoir empty and full) was discussed. The study included laboratory model tests and computations by finite element method, two and three dimensional analysis. A report of this work is available which requires translation.

A study of dynamic behavior of the arch dam at Feng-Le Reservoir which included laboratory model tests to determine the natural frequency of the structure was briefly

reviewed. We requested a copy of the results of this work when completed.

The Nanjing Hydraulic Engineering Research Institute started its research activity on structural dynamics, earthquake engineering, and soil dynamics only a few years ago, mainly after the Tangshan Earthquake of 1976. The main effort on structural dynamics and earthquake engineering includes the investigation of dynamic characteristics of hydraulic structures and earthquake resistance measures for such structures plus similar work for harbor and offshore facilities. Dynamic model testing techniques have been investigated to check the safety of specific hydraulic and harbor structures when subjected to major seismic events. These studies are also conducted to improve seismic design and analysis, and to search for methodology to decrease earthquake damages. Soil dynamics research activity includes development of laboratory and field test equipment; liquefaction of saturated sand studies; collecting computer programs for dynamic response analysis of earth structures; and use of explosives to simulate seismic events.

Shanghai

Discussion topics included testing and research to determine shear modulus and damping ratio of cohesive soils under earthquake loading conditions. A translated report on this effort is available. Other reports requiring translation are available on "Geotechnical Properties of Shanghai Soft Soils" and "Experience and Design Methods of Pile Foundations in Shanghai."

Copies of all papers on research studies in China will be made available to Service engineers and others by request. Additional technical information is expected as a result of this assignment, which will also be disseminated.

Opportunities for Cooperation in Science and Technology

China has vast land and water areas. The distance from east to west measures over 5,000 kilometers (3,100 miles) and from north to south over 5,500 kilometers (3,400 miles), for a total land area of 9.6 million square kilometers (3.7 million square miles). The Yangtze River Gorge Project will be the key effort to regulate the Yangtze River, which would control a drainage area of approximately one million square kilometers (386,100 square miles). The annual average runoff is 453 billion cubic meters (367 million acre-feet). The actual measured maximum flood discharge was 71,100 cubic meters per second (2.5 million cubic feet per second) in 1896 and the historical extraordinary flood was 110,000 cubic meters per second (3.9 million cubic feet per second) in 1870.

The probable maximum flood of the Yellow River at Chengzhou has been estimated to be 46,000 cubic meters per second (1.6 million cubic feet per second), which greatly exceeds the flood-carrying capacity of the Yellow River. To bring the Yellow River under control, soil conservation work, construction of dams, and silt detention reservoirs are necessary.

Enlargement of the original Grand Canal is being considered in addition to plans for conveying water and constructing new canal works that will eventually supply Beijing with water passed from the Yangtze Gorge Reservoir to the Dan-Kiang-kou Reservoir. This complicated and expensive scheme is not near term. However, some Chinese planners believe it will eventually be necessary to solve the drought problem of China's northwestern provinces.

Estimates are that one-third of water-laden lands require draining; half the saline-alkali lands have yet to be improved; while half of the present cultivated acreage has yet to be placed under irrigation.

Research, planning, design, construction, and operation and maintenance needs are enormous to complete all of the above objectives by the turn of the century or thereafter.

Technology is needed to analyze the stress and stability of high concrete and earth-rockfill dams over 200 meters (656 feet) high under seismic loads and other conditions that exist in China. Foundation treatment studies are required to solve the problem of liquefaction in sand-gravel foundation conditions, and rock foundations with soft embedded layers. Cavitation and energy dissipation of high velocity flows exceeding heads of 200 meters (656 feet) are of concern to the Chinese. Reservoir siltation and downstream silt control require study.

Assistance is needed in the design of large hydroelectric powerplants, above ground and underground, in addition to design and manufacture of 0.5 to 1 million kilowatt turbine-generator units. Also, there is interest in the analysis of pump-turbine reversible units and bulb turbine-generators.

Design of large high-head locks under the conditions anticipated by the Chinese require study. Add to these the need to develop construction technology and equipment for the development of large hydraulic structures.

Couple the above with the technological exchange protocol entered into on August 28, 1979, between the Peoples Republic of China and the United States, then the challenges and opportunities that are ahead offer a rare experience for all parties involved.

In conclusion, we found the Chinese people to be sincere and friendly. Their engineers and scientists are technically competent and interested in the systems and procedures we have used to develop our successful water resources facilities. They are eager to employ our advanced concepts in research, planning, design, construction, and operations and maintenance. Cooperative conditions in China offer an excellent opportunity to advance the state-of-the art of water resources development. ■

The Imperial Palace, also known as the "Forbidden City", Beijing.

Environmental Education: Choices and Ethics

Choices

By Sheila Hamrick

Chocolate or vanilla.
Right or left.
Polyester or wool.

Choices—all around us—everyday of our lives. The human fiber stretched against the grain as we strive for stability within our surroundings. At home, at work, at play, we mingle with the variables of our environment.

And there's that word again, "environment," as if it were polished and new. A common misconception conjures up a vision of untamed wilderness. In reality, we live within a multitude of environments. Each with unique characteristics. Each with demands. Each making us choose.

Every person bases his reason for choice on a different set of standards or values. What may rank as the highest of priorities at a given moment may seem irrelevant at another point in time. We rationalize, we compare, we change.

Sheila Hamrick and Carlos Whiting are Public Information Specialists in Washington, D.C. They are coordinating a Water and Power Resources Service program of environmental education.

We are molded and influenced greatly by the surroundings or environment in which we are born, raised and educated. Many of the values that we hold throughout a lifetime are engrained in our thought processes by a very early age. Is it any wonder that we experience the vast number of controversies within our society?

The element of choice or decisionmaking becomes even more complex when large numbers of people are in competition for a limited supply or service. The situation is still compounded when that entity is a necessity and not just a frill or luxury.

The decisions we make regarding our environment have extensive impacts, some far greater than primitive man could imagine. Our natural resources must be shared among growing populations with ever-increasing demands. The supplies are limited. Shortages have become an all-too-familiar reality. The choices are not easy to make.

Environmental education is an attempt at raising the awareness level of children and adults with regard to their natural and man-made environments. Government agencies, educators, and private associations are banding together to develop a program of information and education that will ultimately affect all of us.

But, awareness and appreciation are abstracts that won't emerge overnight. The goals are primarily long-range in scope with particular emphasis on the education of elementary school children. They are the decisionmakers of tomorrow. Environmental education is an investment aimed at producing a more enlightened and informed public to manage our natural resources through conservation practices.

The process of environmental education includes both formal and informal instruction. Outdoor study areas, interpretive programs in parks and around recreation facilities have gained a lot of publicity. But, environmental education is as close as the local schoolyard or the kitchen sink.

The Water and Power Resources Service's environmental education program focuses on the conservation and management of water resources. It blends a concern for the natural environment with the expense of man's technology and development.

Through educational materials, teacher training workshops, tours, and public presentations, Water and Power works cooperatively with other agencies, groups, and individuals to support environmental education whenever possible.

This concept is new to many people but it need not be foreign. The complexity of the times has changed environmental education from a luxury to a necessity—and not a moment too soon.

Ethics

by Carlos Whiting

Several "ethical touchstones" are used by all of us in decision-making. These ethical concepts are, in effect, devices by which we test our values and behavior. They also determine our environment.

For example, sometimes we follow the "me first" concept of paramount personal interest. Or, in civics book idealism, we speak of the greatest good for the greatest number. Sometimes we place our priorities on "place," as we do in watching out for our homes, revering the Fatherland, or fighting to protect the wilderness.

There are other ethical criteria which range from "situational ethics" to obedience to Authority, with a capital "A."

Environmental ethics, it seems to me, may best be appreciated and understood as a basic reverence for life. This does not mean that all living things have a right to exist untouched by man. As Albert Schweitzer himself pointed out, this ethic calls for each of us to make value judgments and good decisions so that balances favorable to the "good life" may be struck among all alternatives for action.

Some forms of life and some lifestyles may be valued at various times more than others. Schweitzer illustrated his point in his desire to save the life of an egret with a broken wing and to restore the beautiful creature to the natural world. To do this, Schweitzer (who valued aquatic life as well) had to catch fish to feed and sustain the egret.

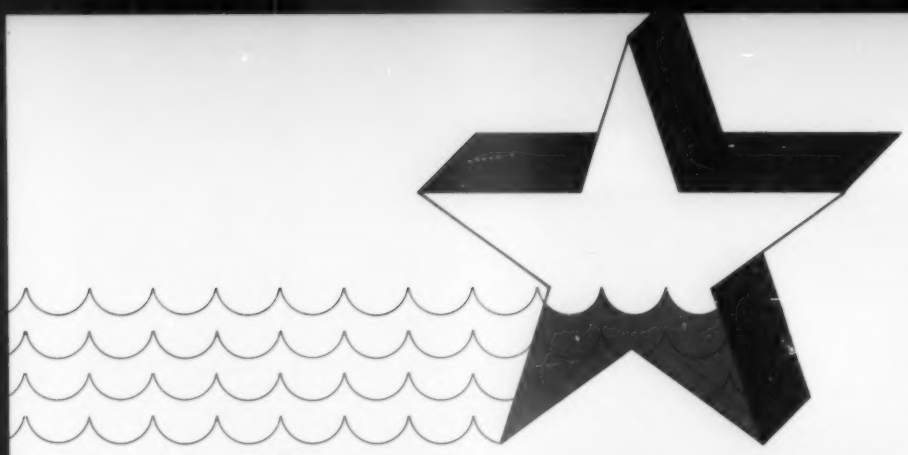
What is appropriate at one time and in some circumstances may not be wise or desirable under other conditions. Some of us will maintain a fine lawn beside our homes, and others among us will cherish a garden. There is a place in our environment for untouched woods and forests. We must also have our orchards.

Where, when, and how we do things—or deliberately leave them undone—requires an understanding of the possibilities, the results or consequences of our decisions and efforts, and the values we hold.

Those who are observant and wise will recognize that all things coexist in interlocking systems, everything dependent upon what happens to everything else. The so-called material or "non-living" world—stretching from craggy mountain faces to great concrete dams, and the very walls and furnishings of our homes—is all part of this web of life.

Equally realistic are ecological ties to our life of ideas, art, music, history, economics, and politics. How we view life is important, for increasingly more of our environment is manmade.

Environmental ethics is really a "code" of our own making which helps us to determine relative values and to make decisions affecting them. Environmental education helps us to formulate our own code of ethics, based upon our understanding of the infinite complexity and "interconnected-ness" of all life. ■



Water Conservation Opportunities On Federal Irrigation Projects

by Bruce Glenn

Water could be used more effectively on many Federal irrigation projects in the western United States. This is the conclusion of the Water Conservation Opportunities Study, a joint report of the Bureau of Reclamation (now the Water and Power Resources Service) and the Bureau of Indian Affairs. This study is but one of the many being done by the Federal Government concerning conservation and other water-related programs. It is in response to a new national emphasis on water conservation as part of President Carter's Water Policy, announced in July 1978.

At the outset, the study team was faced with the difficult problem of defining water conservation. Historically, the term "conservation" and specifically "water conservation" has had a broad definition which includes the wise and judicious use of a resource. This is the Teddy Roosevelt definition and includes the construction of dams and reservoirs for the capture and control of spring flood waters for beneficial release later...a definition that has served the Reclamation West well for more than 77 years.

Today, "conservation" has acquired a new, more narrow definition that has been shaped by an increasing awareness of the limitations of our resources, be they land, minerals, energy, or water. This new conservation ethic emphasizes efficient use of existing supplies and reductions in demand, in contrast to programs to develop new sources of supply.

The Carter Administration's meaning of water conservation is as follows:

"Water conservation should consist of proposed changes that will (a) reduce the demand for water; (b) improve efficiency in use, and reduce losses and waste; and (c) improve land management practices to conserve water..."[1]

For water supply systems this definition of water conservation means making existing developed supplies provide additional service, and thus avoid or postpone costly additions to supply systems.

This does not mean that water conservation is the sole activity to be pursued under the new water policy or that structural solutions to water supply problems will not also be considered (see "Water Conservation Is?" by Guy Martin, Assistant Secretary for Land and Water, *Reclamation Era*, Vol. 64 No. 3). However, it does mean that more efficient use of existing supplies will receive increased emphasis in the Water and Power Resources Service.

Federal projects provide water to approximately 10.6 million acres of land, which represents 20 percent of the irrigated cropland in the western United States. The remainder is under the control of private or other interests. About 90 percent of the water consumed in the 17 Western States is agricultural.

[1] Second Progress Report on the Implementation of the President's Water Policy Initiatives, January 23, 1979.

Bruce Glenn is a general engineer in the Plans Coordination and Report Branch, Engineering and Research Center, Denver, Colo. He was a member of the Water Conservation Opportunities Studies Team and he assisted in coordinating the work of the Water Policy Task Force, headed by Assistant Secretary of Land and Water Guy Martin.

Using funds made available by the Emergency Drought Act of 1977, Water and Power and the Bureau of Indian Affairs coordinated a 2-month field level survey of those irrigation projects appearing to have opportunities for conserving water. Engineering, economic, environmental, social, legal, and institutional information was assembled for 46 Service and 15 Indian Affairs study areas. These 61 projects which presently deliver 11.9 million acre-feet of irrigation water annually to 2.4 million acres were examined.

The information was analysed in an evaluation process using 14 factors reflecting the desirability of project improvements within 4 alternative future scenarios: continuation of present trends: emphasis on environmental and social values; increased demands for water; budgetary constraints. The data were used to rank the 61 study areas according to factor scores within each scenario and a summation of scores for all scenarios.

The ordering was not a precise evaluation of the relative merit of each study area. However, the evaluation procedure used - which was based on subjective, judgmental techniques - provided a general indication of the study areas which appeared to be the most attractive and those which appeared to be the least attractive.

The study of each project involved a preliminary estimate of (1) the amount of water that could be conserved and the probable disposition of that water; (2) the water conservation measures that could be implemented; and (3) the economic, institutional, and environmental impacts of those measures.

Identifying water that could actually be conserved on a typicai irrigation project was difficult for the team because of the interdependencies of water supply that exist between water users in a river basin. It is not sufficient simply to identify the amount of re-

Friant-Kern Canal north of Orange Cove, Calif.

Unlined Madera Canal, Central Valley Project, Calif. - 1967.

duced diversions that could be accomplished. Most of the water applied to the irrigated fields, but not consumptively used by the crops in the growing process, returns to the river basin's stream system or groundwater supply. That water is then available for appropriation and use at a later time. Thus, only a small fraction of potential reductions in water diversions can be recovered for new beneficial uses without adversely affecting another irrigator's water supply.

The study identified two categories of water. The first was an estimate of the amount of water currently being lost to any beneficial use on existing projects. On the 61 projects studied, this amounted to 0.7 million acre-feet. The second was an estimate of the amount of reduction in diversions that could be achieved on specific projects while still meeting project water commitments. This latter figure is relatively large, totaling 3.1 million acre-feet. This potential reduction in diversions at a cost of $1 billion provided a major indicator of where there are possibilities for better utilization of water. However, about 80 percent or 2.4 million acre-feet could potentially interrupt return flows that are currently being used for other purposes.

The measure of water that could actually be made available for new beneficial uses in a given stream system is more nearly represented by the amount identified in the first category as "water lost to further use." The estimated 0.7 million acre-feet was identified as that water not used by the crop in the growth process, not utilized by adjacent or downstream users, or not reaching a usable groundwater aquifer. It was water that ended up in a saline aquifer and in other locations where ground characteristics are such that the water cannot be recovered, or water lost through use by noncrop vegetation along the water delivery system. This represents the maximum amount of water which could be

Lined Madera Canal, Central Valley Project, east of Fresno, Calif. - 1972.

Table 1.—Water Conservation Summary

Study Areas	Total Irrigated Acres	Water Lost To Further Use (AF)	Estimated Annual Reduction In Diversion (AF)	Total Investment Cost ($k)
Pacific Northwest Region - Water and Power	210,840	183,254	624,145	201,596
Mid-Pacific Region - Water and Power	194,146	6,867	181,575	126,750
Lower Colorado Region - Water and Power	505,763	93,800	477,700	299,489
Upper Colorado Region - Water and Power	288,203	3,600	191,900	148,996
Southwest Region - Water and Power	97,253	64,350	38,500	6,857
Upper Missouri Region - Water and Power	391,621	296,400	532,900	105,313
Lower Missouri Region - Water and Power	307,458	34,638	245,200	62,282
Navajo Area - Indian Affairs	21,203	411	47,248	11,203
Billings Area - Indian Affairs	46,390	16,778	34,100	4,250
Portland Area - Indian Affairs	159,778	0	299,800	39,800
Phoenix Area - Indian Affairs	147,948	2,300	414,904	73,484
Total	**2,370,608**	**702,398**	**3,087,972**	**1,080,020**

made available without interfering with existing uses within the stream system.

Economic considerations will play an important part in determining those projects where water conservaton activities should be pursued. Preliminary estimates of costs and associated benefits were made. Indications are that costs may be greater than expected monetary benefits in most cases. Furthermore, many of the benefits accrue to individuals other than the ones who would likely have to undertake the water conservation measures. This suggests that the programs will have to be broadly based with means to financially assist those individuals who undertake water conservation. It also suggests that better indications of noneconomic benefits of water conservation are needed.

Further detailed studies on individual projects will carefully address the potential alterations of flow quantities and patterns of occurrences for overall stream systems. This information will be used in evaluating the absolute extent to which proposed measures could be expected to conserve water for new or supplemental use.

It was recognized that legal and institutional problems will influence how much water conservation may be carried out. General indications were made of the type and incidence where legal or institutional problems were likely to occur. For example, in some locations while large reductions in diversions may be achieved, the current beneficiaries and owners would probably not be agreeable to new beneficial uses of water outside present service areas, particularly if they were required to make the additional expenditures. In many cases it would be difficult to identify beneficiaries and thus obtain a financial sponsor. In some cases, the implementation of conservation measures may not be compatible with existing contracts since water rights of users outside the study areas could be harmed. Litigation by such users to preserve the integrity of the supplies would be a possibility.

The study provides a basic support for a water conservation action program in which detailed site-specific studies of irrigation water use and management will be carried out.

Table I displays, for each Service region and Indian Affairs area, a summary of the potential opportunities to conserve water.

Water conservation measures studied include installation of canal linings, pipes, sprinklers, trickle or drip irrigation facilities, water measurement devices, and improvement of conveyance and on-farm management practices.

Of the 3.1 million acre-feet of reduced diversions, 2.05 million acre-feet or 66 percent would result from improvements in facilities and operation of irrigation water conveyance and delivery systems, and 1.05 million acre-feet or 34 percent would result from improvement of on-farm irrigation systems and operation.

Total annual costs for the measures proposed vary substantially among areas, but generally fall in the $10 or $40 per acre-foot of reduced diversions. Costs for water actually recovered for new

beneficial uses would be substantially higher.

Environmental effects of conservation measures for a specific study area can be both beneficial and adverse. Typical beneficial effects would be the stabilization of reservoir surface if less water were diverted, improvement in water quality if return flows are reduced, and improved instream flows. However, the study found that there could be significant adverse environmental impacts in most study areas due to such factors as loss of wildlife habitat along canals and lowering of lake levels that depend on return flows for supply. Also, water conservation programs could have an adverse effect on energy conservation programs since conversion to sprinkler application of irrigation water and recycle plans would require significant amounts of energy.

Economic and financial aspects of water conservation need careful attention. On the one hand, increased water charges may be appropriate to encourage more prudent utilization. On the other hand, economic incentives such as cost-sharing programs or reduced payment requirements may be appropriate where beneficiaries are other than those who undertake water conservation.

Cooperation and coordination among Federal, State, and local entities will be necessary to improve the effective and efficient use of irrigation water where such use is not now practiced.

A number of the analyzed projects show potential for water conservation. The study recommends scheduling investigations, identifying feasible projects, and seeking authority and funding for further detailed studies. Many of these detailed studies have been initiated or are scheduled in the future by the Water and Power Resources Service.

In most cases successfully implementing a water conservation program will require the cooperation of water users, state entities, and the Federal Government as we seek, in a practical way, to make more efficient use of the Federal irrigation system that is now in place. ■

Central Valley Operations Control Center in Sacramento, Calif.

Siphon irrigation system near Sacramento, Calif.

Side-roll sprinkler irrigation system, near East Bench Canal, Mont.

MONUMENT TO COURAGE

by Morgan Malone

Camp Minidoka at Hunt, Idaho, was established by the War Relocation Authority in 1942 to house 10,000 Japanese-American evacuees behind barbed wire. Remains of the camp on Water and Power Resources Service land were recently dedicated as a National Historic Site.

In less than 2 months in 1942, Hunt's relocation center mushroomed out of sagebrush wasteland into the eighth largest city in Idaho. Most of the Japanese-Americans there were American citizens from the States of Oregon, Washington, and Alaska. They had been given less than one month to sell their homes and other properties, and report to the camp—one of ten located throughout the West.

The administration area at Camp Minidoka.

Under armed guard, evacuees faced living in wood and tarpaper barracks with composure and quiet heroism. They raised garden vegetables to supplement food supplies at the 946-acre camp.

With great spirit in the face of bitterness, they reclaimed almost 100,000 acres of desert land. Even now, areas still bloom there from the time the Service and Japanese-American engineers worked together building irrigation facilities.

The industriousness and pride of these people helped make the camp a better environment. The

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desert community was a radical change for its residents from the Pacific Northwest. Thirty-seven blocks of apartments housed approximately 274 people in each block. Other facilities included a 600-bed hospital, grade and high schools, a post office, theatre and recreation hall, commissaries and laundries, kitchens and dining rooms. Those returning to its confines each night from work in the fields and surrounding communities were painfully aware of internment.

Of the 300 predominantly middle-aged Japanese-Americans attending the dedication ceremony on a rainy August morning, many had served in the armed forces during World War II. More than 900 volunteers came from Camp Minidoka, which had the highest volunteer percentage among all 10 relocation sites. Veterans of the most famous Japanese-American fighting force, the 442nd Regimental Combat Team, presented the colors for the dedication ceremony.

The 442nd Regimental Combat Team was the single most decorated unit for its size in American military history. Their slogan "Go For Broke," was known throughout the fighting forces. The unit landed in Italy in mid-1944 and later fought in France. Among its honors, the unit received four separate Distinguished Unit Citations and 18,000 individual decorations.

Rod Vissia, Water and Power's Regional Director in the Pacific Northwest Region, praised Camp Minidoka's residents for their ability to overcome national fears and prejudices with faith and diligence. "I hope in the future, when our country faces a national crisis such as it did in the early 40's, that we *not* react from a position of fear, suspicion, prejudice; but that we react from a position of confidence, trust, and a respect for all of our citizens' rights."

Senator Frank Church of Idaho sponsored the nomination of Camp Minidoka as a National Historic

One of those who remembered.

Ruins of the Visitors' Reception Center.

Evacuees raised vegetable gardens to supplement food supplies.

Site. In his remarks at its dedication, he said "...it is not without significance that today in the Senate of the United States there are three members—Danny Inouye, Sparky Matsunaga, and Sam Hayakawa—all of Japanese descent. That is the largest representation in the Senate of the United States of any minority group in our population, and it testifies to the recognition of all our citizens, not only of the mistakes of the past, but of the great loyalty of the Japanese-Americans in our midst."

Bill Hosakawa, Associate Editor of *The Denver Post*, spoke from his personal involvement in the camp's dedication. Hosakawa was a young newspaper reporter when he was sent to the Heart Mountain Relocation Center in Wyoming. His parents were sent to Camp Minidoka. He had been isolated by the military as a "potential troublemaker" after criticizing restrictions and living conditions while detained in temporary housing prior to camp internment.

Hosakawa said that the memorial will remain "...a testimonial to the fact that even though mistakes of judgment are inevitable, good will, moral courage, and the democratic system can in time correct them."

Camp Minidoka closed in 1945. Japanese-American families returned penniless to their old homes, having sold their residences before relocation or finding their land sold for taxes in their absence. They rejoined the mainstream of American life with the same productive spirit that remains today.

As a National Historic Site, Camp Minidoka will serve to remind us of the tenets of the Constitution. With perseverence and industry, the behavior of the Japanese-Americans, victimized by wartime hysteria, will always remain a monument in American history. ■

Veterans from the 442nd Regimental Combat Team presented the colors.

YACC

An Investment in the Future

The Program

by Cassandra Larkins

Throughout America, young men and women are experiencing the satisfaction of learning a trade while getting paid. These young adults, aged 16 to 23, are involved in many types of conservation work on national parks and forests, fish hatcheries, wildlife refuges, and other public lands. They participate in a federally funded program called the Young Adult Conservation Corps (YACC), which offers challenging and meaningful work to young people in need of jobs.

The high rate of unemployment among this age group, coupled with the desire to complete the much needed conservation work on federal projects, prompted the United States Government to create the YACC in 1977. Patterned after the successful Civilian Conservation Corps (CCC) program of the 1930's, YACC is jointly administered by the Departments of Labor, Agriculture, and Interior. While Labor's Employment and Training Administration is responsible for the referral of prospective enrollees through State employment agencies, Agriculture's Forest Service and Interior's agencies select the enrollees, and establish and manage the camps and projects.

Enrollees are young adults from all parts of the country and from all social, economic, and racial backgrounds. Preference is given, however, to prospective enrollees who reside in areas which have an unemployment rate of 6.5 percent or more. The program requires enrollees to be:

- 16 through 23 years of age;
- unemployed;
- citizens or lawfully admitted aliens;
- out of school (enrollees must give assurance they have not left school for the purpose of entering the Corps and are not using the program for summer employment);
- capable, as determined by the Labor Department, of carrying out the work of the Corps (each individual must provide a record of physical examination before enrollment, have a social security number, and have a work permit if required by State law).

All YACC participants report to staff crew leaders who assign jobs, teach job techniques, grant leave, review and evaluate work, recommend promotions, and provide counseling.

Corps members are trained to perform in many areas of conservation. Some assist in conducting surveys, drawing maps, and monitoring recreation activities; some perform as clerks, warehousemen, and painters; others are organized into construction and maintenance crews to work on fences, pipelines, waterways, roads, trails, and recreation sites.

The pay is $2.90 per hour and Corps members have an excellent chance for advancement. Those who have demonstrated the ability to take on extra responsibilities may be assigned as assistant crew leaders and earn $4.35 per hour. Enrollees earn 4 hours of administrative leave every pay period.

Cassandra Larkins is a Writer-Editor, Office of Public Affairs, Commissioner's Office, Washington, D.C.

Photography by Bud Rusho, Upper Colorado Region, and Glade Walker, Pacific-Northwest Region.

YACC member is instructed on how to work with sheetrock during restoration of Bishops House in Boise.

YACC members construct chainlink fence at Rio Linda Park, California.

YACC member runs levels for retaining wall at Nimbus Dam, California.

Corps members prepare trench for retaining wall at Nimbus Dam, California.

YACC enrollee checks grade and level of sprinkler system being installed at Black Canyon Reservoir, Idaho.

which can be used in case of illness or as an extra day off in addition to 9 paid holidays.

One of the most important features of the YACC is the safety program. Enrollees are trained to follow good safety habits. They are required to wear the proper safety equipment, their tools must be in good condition, and they must have well-lighted, safe working conditions. Anyone who fails to comply with the safety regulations may have their employment terminated.

Because of Water and Power's involvement in conservation-related work, the Service enthusiastically agreed to participate in this program. During 1978, the Service operated 11 camps with a Corps member capacity of 979. The Federal Government invested $7,307,500 in Water and Power camps during 1978. The appraised value of the work accomplished by the camps totaled $5,027,000, a return cost of 90 cents for every dollar invested.

An example of the program's success is the Service's YACC Boise camp. This camp is involved in restoring the Old Bishops' house in Boise, Idaho. The house was built in 1887 and remodeled in 1899. For decades, it was used as a residence for Episcopal bishops. Several years ago the house was moved to a new location. Now it belongs to the State of Idaho and is being restored through the efforts of many organizations and Water and Power's YACC.

Officials at the Idaho State Historical Society believe the project would not have been successful had it not been for the cooperation and labor of the YACC.

Other accomplishments can be seen in the Sacramento region. Recently, Corps members cleared dead trees and put up 10,000 feet of fencing at the Prairie City off-highway vehicle park near Rancho Cordova, Calif. A few months ago, Water and Power's YACC finished a project for the Sunrise Recreation and Park District. Enrollees put up fencing on Little League baseball fields in Orangevale to keep motorcyclists from tearing up the turf. To date, Service Sacramento camps have worked a total of 268,000 man-hours on many projects in the area.

Through the Young Adult Conservation Corps, young men and women are learning good work habits and becoming better qualified to enter the working world. The significant amount of quality work these young people have been able to accomplish is helping to establish the YACC program as a contemporary counterpart of its popular predecessor, the Civilian Conservation Corps. But, the YACC has created its own favorable reputation through the achievements of young people and the successful conservation work accomplished on our public lands.

Dedication of Timpanogos Center

by Bob Petersen

With majestic Mt. Timpanogos towering in the background, young adults busily decorated the speaker's podium, set up chairs, and spruced up the already immaculate grounds at the Timpanogos YACC Center in Lindon, Utah.

Tourguides put the finishing touches on exhibits, greeters readied nametags, and performers rehearsed one last time. The focal point for all this activity by YACC workers was the July 25 dedication of the Timpanogos Center by Commissioner R. Keith Higginson. YACC enrollees from Utah, Colorado, and Arizona joined Water and Power, local officials, and hundreds of townspeople in the festivities at the Timpanogos YACC dedication and open house.

Commissioner Higginson, noting that it was "difficult to entice a Government official away from Washington during these times of energy crisis and political turmoil," said that it was nonetheless a great pleasure for him to meet with young people involved in such productive work. He further applauded the work program because of the excellent results achieved each year.

"The purpose of your involvement in these programs is not merely the accomplishment of work, but includes other important purposes as well. Purposes such as the development of the per-

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Bob Petersen is an Intern in the Upper Colorado Region, Salt Lake City, Utah, and an MBA student at Brigham Young University.

Photograph by Paul Page, Bud Rusho, and Doug Cowley, Upper Colorado Region.

YACC member Darlene Neff uses forklift to place dedication plaque at entrance to Center.

Commissioner of Reclamation R. Keith Higginson and Karl R. Lyman, Chairman of Utah County Commission, unveil plaque.

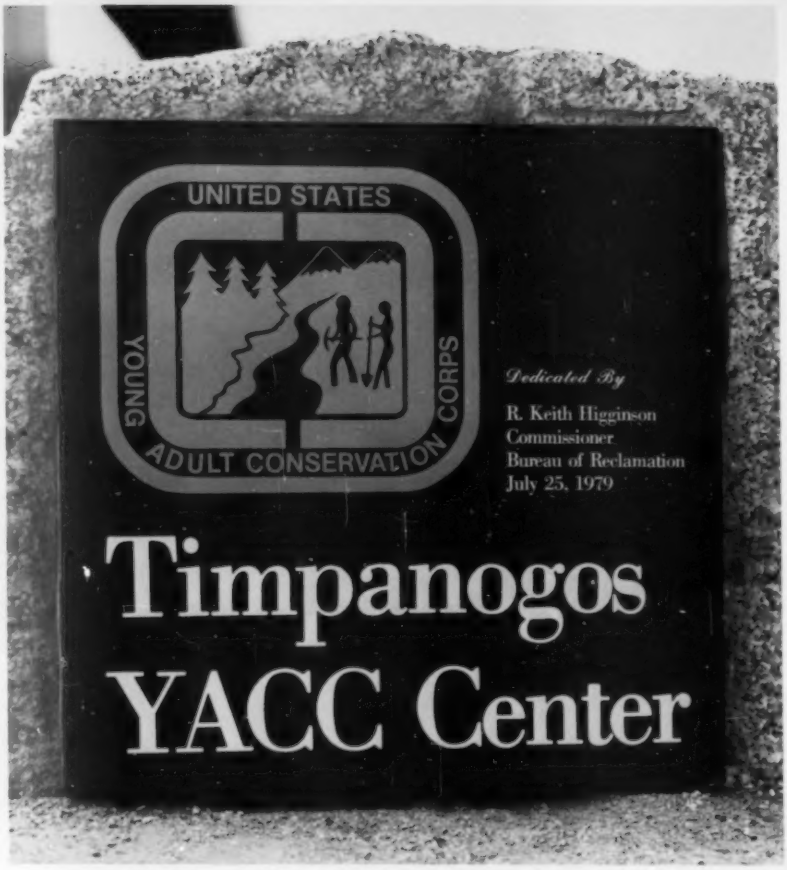
sonal, physical, and intellectual resources of each one of you. Whether you're involved in carpentry, painting, or field work such as laying fences, restoring streambeds, or building campgrounds, you are gaining experience with tools and work skills that should benefit you in later life."

In addition to the Commissioner, speakers at the dedication included Governor H. Aker, Director of the Office of Youth Programs, Department of the Interior; Wilson W. Sorenson, President of Utah Technical College in Provo, Utah; and Patricia Brown, a YACC employee at the Timpanagos Center.

Ms. Brown, a worker in the sign and paint shop at the center, illuminated some of the frustrations encountered by young people seeking jobs today. "You can't get a job without experience and you can't get experience without a job," she said. "The YACC has given me a chance to prove myself and I take real pride in my job and what I do."

After growing up on a small Indian reservation, Ms. Brown decided to leave to find out what the world is all about. "After a year of trial and tribulations without much success, I returned home. I wasn't satisfied with life at home so I moved on and here I am in Utah working for the YACC. At YACC we learn about good working habits: being dependable, following instructions, and something very important—safety awareness."

Although the workers at Timpanogos YACC come from varied backgrounds, all of them find a common bond in working as a team. Each worker follows his or her interests and finds an important skill to develop which complements the other jobs in the work projects conducted at the center. The 150 youth work in various conservation and construction related activities including surveying, concrete finishing, carpentry, sign construction, fence building, welding, and office work. Workers in several large and well-equipped shops performed the carpentry work, welding, and sign construction. Signs fabricated at the Timpanagos Center are of professional quality and will be used for many Water and Power purposes in the region. These vitally needed projects on public lands contribute to the overall Service effort to provide the country with quality recreation areas, wise conservation practices, and Government facilities at reasonable cost.



Timpanagos YACC director Val Rohde described the way the program helps young people become successful: "Armed with pie-in-the-sky dreams, perhaps a bit of education and theory under their belts, but little experience to prepare them, they face the reality of a world that demands much. YACC aims to make the transition into the real world easier, and helps to translate high hopes into tangible accomplishments."

With the dedication at Lindon, the workers at the Timpanagos YACC Center now officially join the army of YACC young people 40,000 strong across the Nation. ■

Water Quiz

1. The world's supply of 326 million cubic miles of water would, if poured upon the 50 United States, submerge the country to a depth of:
   a. 90 miles
   b. 150 miles
   c. 200 miles
2. The earth holds more than ____ of water underground:
   a. 2 million cubic miles
   b. 5 million cubic miles
   c. 8 million cubic miles
3. Humans can live ____ days without water.
   a. 3
   b. 5
   c. 10
4. Groundwater enters the root hairs of a plant by a special kind of diffusion called:
   a. osmosis
   b. population dynamics
   c. feeding stage
5. The human body has ____ sweat glands, which work unnoticed at normal temperatures, and step up their activity whenever the body becomes overheated.
   a. 1,000,000
   b. 2,000,000
   c. 3,000,000

Answers to Water Quiz on page 36

Skywater weather stations monitor Gulf oil spill...

A Nice Place to Visit But...

by Jim Joslyn

Every 20 seconds the foghorn screamed. The wind kept changing, driving the rain from all directions. They huddled behind equipment high on their perch above the angry sea.

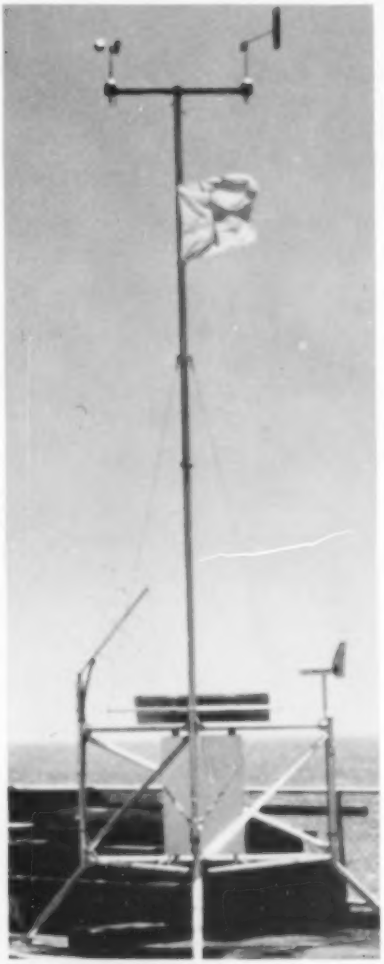
What a way to make a living.

Bill Harrison and Al Bessol were stranded. In the ocean. In a storm. Their island...an unmanned offshore gas platform in the Gulf of Mexico. The turbulent weather was preventing their ride, a transportation service helicopter, from rescuing them.

The horn blasted again. It was as bad as the weather. "It nearly drove us crazy," said Harrison.

Harrison, an electronic engineer, and Bessol, an electronic technician, work for the Service's Office of Atmospheric Water Resources (Project Skywater). Stationed in Denver, their jobs normally take them to the High Sierras of California or the plains of Montana. This, however, was a special assignment. And a "special" experience.

On June 3, 1979, an oil well blew out off Mexico's Yucatan Peninsula, about 500 miles south of Texas. During the next several weeks, hundreds of thousands of barrels of oil spread in huge patches over many miles of ocean.



Solar weather station installed and operating on unmanned gas platform.

Gulf winds pushed the sticky crude toward the beaches of Texas.

The spill was so large—one patch was at least 450 miles square—that efforts to control it were marginal at best. Eventually, globs of oil covered south Texas beaches.

One of the problems in the control effort was a lack of adequate weather monitoring facilities. There was no way to quickly and accurately keep tabs on the unpredictable Gulf weather. The National Response Team, a group representing several Federal agencies that respond to disasters, asked for Water and Power's help.

In March of 1979, the Service had contracted for the manufacture of 150 solar-powered weather stations to use in cloud-seeding research. About 20 feet high and weighing 400 pounds, these rugged stations can withstand winds in excess of 100 miles per hour. They can be assembled and dismantled in only a few hours. Most importantly, they are powered by the

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Jim Joslyn was a writer-editor in the Public Affairs Service Center in Denver, Colo.

Photography by Bill Harrison and Al Bessol.

Solar weather station installed and operating on unmanned gas platform.

sun. They need no other source of power and operate unattended. Their batteries draw power from photovoltaic panels that convert the sunlight to electricity. The weather information they collect is transmitted by satellite and processed by computer. It's fast and accurate.

Installing these weather stations on offshore oil and gas platforms would enable meteorologists and other scientists to have access to current conditions. This information would help them monitor, as well as forecast, the fickle and often volatile weather over a wide area of ocean. The Coast Guard, coordinating the overall control effort, and the U.S. Weather Service determined that six of the stations would provide an adequate "watch" on the weather in the Gulf.

At this point Harrison enters the picture.

Harrison is the project officer responsible for installing the solar stations in the Service's weather research programs. When the stations were requested for the oil spill emergency, it became his job to get the stations operating in the Gulf as soon as possible.

The six stations to be used were located in Miles City, Mont. On August 18, 1979, they were bundled up and flown by a Coast Guard C-130 to Corpus Christi, Tex. From Corpus Christi, headquarters for the spill control program, two of the stations were helicoptered to the closest platforms, about 2 and 14 nautical miles offshore. The other four were boated to the farthest platforms, from 48 to 91 miles out in the Gulf.

The stations were installed by four men working in two-man teams. Harrison and Bessol were together. The other team was Mike Collins, a Service electronic techniciam from Miles City, Mont., and Jerry Price of Electronic Techniques, Incorporated, Fort Collins, Colo., manufacturer of the stations.

"We had to take everything with us. Our food and water, our tools, and any materials necessary to install the stations," Harrison said. "At times, it was unnerving. On one of the unmanned platforms we had to stand on a 3-foot-wide grating around the edge to install the station."

"We worked *very carefully*," Harrison explained, now with a smile as he sat safely in his office in Denver. "Anything we dropped was gone. It disappeared into the ocean 85 feet below us."

"There were other tense moments," Harrison continued. "For several minutes we could watch the helicopter approach the platform with the weather station swaying underneath. It occurred to me that should the pilot have the

slightest bit of trouble, he could jettison that station. And just like that, $10,000 would sink to the bottom of the ocean. I was relieved when the stations arrived safely."

All of the stations had been delivered to the platforms by August 22. The two-man teams had them operational by the 26th. Each station required about 3½ hours to install. They were bolted to the floors of the platforms. The highest platform was about 125 feet above the water, the lowest 85 feet. Used to pump oil and gas, the platforms are owned by Mobil, Superior, and Shell oil companies.

The portable weather stations measure and report windspeed and direction, temperature, humidity, and barometric pressure. This information is transmitted by the Geostationary Operational Environmental Satellite (which orbits the earth at about 22,500 miles) through a ground-receiving station in Virginia to a computer at Water and Power's Engineering and Research Center in Denver. A remote terminal in Corpus Christi, linked to the Denver computer, allows access to current weather conditions in the Gulf.

In addition to helping monitor the oil spill, the stations proved valuable in another crisis. The National Hurricane Center in Miami used hourly data from the stations to keep an eye on Hurricane Henri when it swept through the Gulf area in September.

Late in 1979, the weather stations will be retrieved from the Gulf and placed back in the Service's weather research program.

"It was a unique experience," Harrison said. "I'd never done anything like it before. And, I'm glad Water and Power was able to help."

"But let me tell you," Harrison concluded, "Al and I were sure glad to be rescued from that storm. We waited it out for 3½ hours. Finally, the weather calmed enough for the helicopter to return. I don't care if I ever hear another foghorn." ■

Coast Guard helicopter waiting to return Al Bessol and Bill Harrison to the Texas coast.

Al Bessol does a final checkout.

A Photo Essay

A State-Of-The-Art Perspective

by Gina Salazar

Last August, Vice President Walter Mondale left Andrews Air Force Base near Washington, D.C., to journey 20,000 miles to Beijing (Peking), the capital of the Peoples Republic of China. The eight-day visit is viewed as the symbolic completion of the seven-year effort to normalize relations between the United States and China, thus beginning a new era of cooperation.

The Vice President met with Chinese Vice Premier Deng Xiaoping to discuss Chinese-American relations in general and several topics in particular. One of these is the further development of China's vast water resources to produce hydropower.

One formally signed agreement calls for the assistance of the Water and Power Resources Service, the Army Corps of Engineers, the Department of Energy, and the Tennessee Valley Authority, to help bring some 20 major hydroelectric projects closer to completion. Each project is estimated to cost between $1-2 million.

Because of a special interest by the Chinese in the Service's accomplishments, Vice President Mondale in a private meeting with Vice Premier Xiaoping, presented a group of photographs illustrating Water and Power's facilities and activities. Included in the grouping was a portfolio of photography that won the Professional Photographers of America and the Eastman Kodak's Industrial Photographic Department of the Year Award.

The photographs shown are part of the portfolio, depicting a general representation of people and places in Water and Power's past between 1903 and 1978. ■

Gina Salazar is a Student Writer-Editor Trainee from Colorado State University, in the Public Affairs Service Center, Denver, Colo.

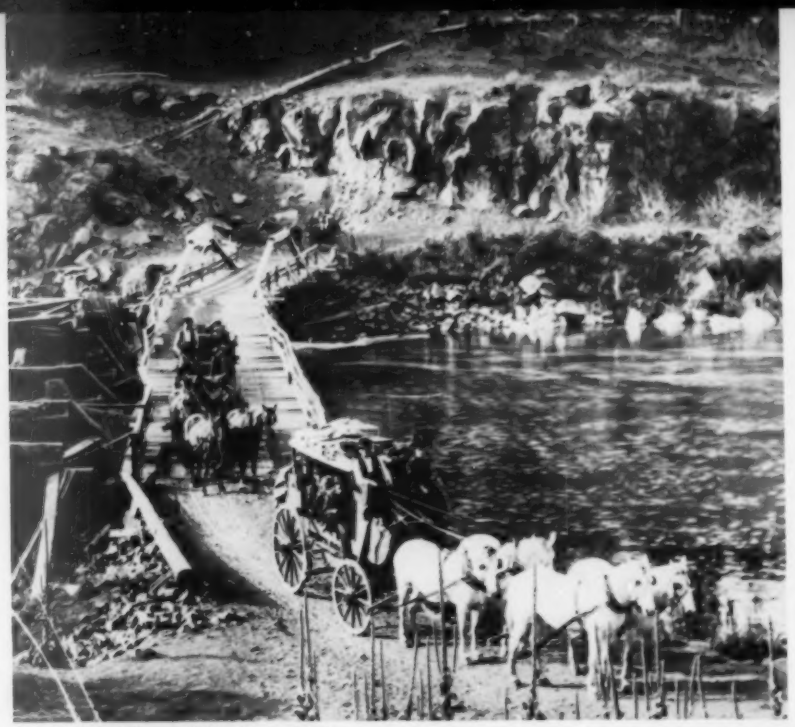
Strawberry Valley Project, Utah - 1906

Sacking cement at Roosevelt Dam, Arizona - 1910

Dedication ceremonies at Roosevelt Dam, Arizona, Colonel Roosevelt speaking - 1911

An Uncompahgre Project, Colorado, farmer named "Slim" Pickins - 1914

34 Central Arizona Project, a Saguaro Cactus - 1975



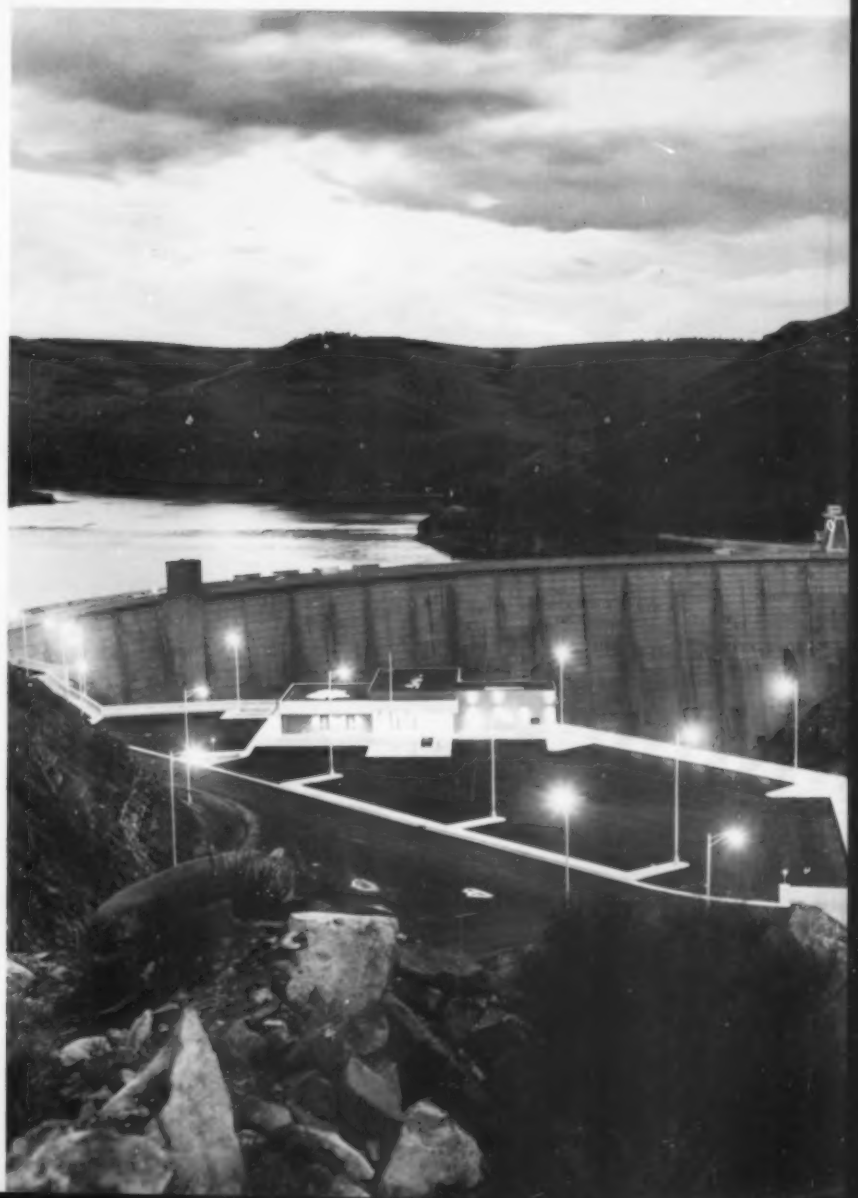
Klamath Project, Oregon-California, - undated

Glen Canyon Dam, Arizona, - 1969

Buffalo Gap National Grassland, South Dakota - 1975

North Platte Project, Nebraska - 1907

Heart Mountain Canal, Wyoming - 1999



Yellowtail Dam, Montana - 1967

Answers to Water Quiz

1. a., 90 miles.
2. a., 2 million cubic miles.
3. c., 10.
4. a., osmosis.
5. b., 2,000,000.

OOPS! We goofed. In the last issue of *Reclamation Era's* Water Quiz, answer 2 was right but the question was wrong. It should have read: What percentage of the energy produced by the Sun **that reaches the Earth's atmosphere** actually strikes the Earth's surface?

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